

Remarks

Upon entry of the foregoing amendment, claims 1-19 and 40-48 are pending in the application, with claims 1 and 11 being the independent claims. Claims 20-39 are sought to be canceled without prejudice to, or disclaimer of, the subject matter therein. New claims 42-48 are sought to be added. Independent claims 1 and 11, and the claims depending therefrom, are amended to further clarify the claims. Support for these amendments is found, for example, on page 71, lines 1-9, and page 86, line 4 - page 92, line 6, of the specification. These changes are believed to introduce no new matter, and their entry is respectfully requested.

Based on the above amendment and the following remarks, Applicants respectfully request that the Examiner reconsider all outstanding objections and rejections and that they be withdrawn.

Examiner Interview of January 26, 2005

Applicants wish to thank Examiner Chung for the opportunity to personally discuss the claims of this application with the undersigned in the Examiner Interview conducted on January 26, 2005. In that Interview, claim 1 was discussed, along with Examiner-cited U.S. Patent Nos. 5,720,019 to Koss *et al.* and 5,982,380 to Inoue *et al.* It was pointed out during the interview that the cited documents do not teach all of the features cited in the independent claims, as discussed below.

During the course of the Interview, various questions were presented by Examiner Chung with regard to certain technical aspects of the invention. These questions are addressed here to assist the Examiner.

One question asked by the Examiner was the meaning of the phrase "at least a portion of" in claim 1, for example. This language has been removed by the foregoing amendment. Hence, discussion of this phrase is now moot.

Another question asked why the coordinates are transformed. The specification states, for steps 1005 and 1010 of process 1000 (starting on page 86, line 13, of the specification) for example, that a graphics image "is framed using points, lines and geometric shapes referred to as 'primitives,' and world coordinates $[x\ y\ z\ w]$ are derived from the vertices of the primitives." The specification goes on to state that "the world coordinates $[x\ y\ z\ w]$ are transformed to $[x'\ y'\ z'\ w']$ by a four-by-four floating point matrix..." and that "[t]ransformation includes rotations, translations, scalings along the coordinate axes, perspective transformation, and combinations of these." It is known by those skilled in the art that vertex coordinates may need to be manipulated (or transformed), and usually are, prior to being processed by graphics-related calculations. There are many possible coordinate transformations that may need to be done. One example of a coordinate transformation used by the present invention is the moving of the origin (i.e., the $(x=0, y=0, z=0)$ point) to the center of a view volume. With this transformation, the invention allows a single comparison between the absolute value of a coordinate (e.g., $|x'|$) and the absolute value representing the distance from the origin to two opposing edges of the view volume (e.g., $|w'|$) to test whether the coordinate is within those two edges of the view volume. If the origin was located anywhere else in the view volume, two separate comparisons may be needed for each coordinate - one for each opposing view volume edge (as is done in the cited art).

A further question asked about the value w' and its relation to the claims. As described in the specification (page 87, lines 16-18, for example), the symbol " w " represents a viewing plane or, more specifically, a view volume edge. The absolute value of w , or $|w|$, represents two viewing planes, or two view volume edges. These two view volume edges are opposing view volume edges. As discussed above, w is transformed into w' along with the other coordinate transformations of $[x\ y\ z]$ into $[x'\ y'\ z']$. Magnitude compare instructions can be used, for example, to compare the absolute values of each coordinate x' , y' , and z' , with the absolute value of w' (see the specification at page 87, lines 7-10, for example). Depending on the data format used, a single magnitude compare instruction can provide comparisons of one, two, or more coordinates. For example, with a paired-single data format, a single magnitude compare instruction can provide comparisons for both the x' coordinate and the y' coordinate, as described in the specification (see page 87, lines 14-18, and page 90, Table 3 and lines 20-23, for example). In Table 3, for example, a single magnitude compare instruction is used to compare $|x'|$ with $|w'|$ and also $|y'|$ with $|w'|$. During the Interview, the Examiner asked if the values of w' in each case would be the same. The view volume can be thought of as a cube, in which case the value of w' would be the same in all comparisons (including a comparison with $|z'|$). However, this is not necessarily the case, and the present invention is not so limited. The symbol w' can have a different value for each comparison. One of the cited references illustrates this. For example, in U.S. Pat. No. 5,982,380 to Inoue *et al.*, in six different comparisons (see Figure 1, for example), the symbol " w " represents the absolute values of viewing planes P_0 , $-P_1$, Q_0 , $-Q_1$, R_0 , and $-R_1$ (where P_0 and $-P_1$ are x -coordinates of the yz -planes, Q_0 and $-Q_1$ are the y -coordinates of the zx -planes, and R_0 and $-R_1$ are the z -coordinates of the xy -planes) (see Inoue *et al.*, col. 5, lines 1-13). However,

there is no indication in Inoue *et al.* that these six values (P0, -P1, Q0, -Q1, R0, and -R1) have the same magnitude.

The Examiner also stated that at least some of the claims may require rejection under 35 U.S.C. § 101. Applicants believe that the foregoing amendment sufficiently addresses the Examiner's concerns with regard to 35 U.S.C. § 101. Therefore discussion of 35 U.S.C. § 101 is now moot.

Rejections under 35 U.S.C. § 103

On page 2 of the Office Action, it states that claims 1-41 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over U.S. Pat. No. 5,720,019 to Koss *et al.* (hereinafter, "Koss") in view of U.S. Pat. No. 5,982,380 to Inoue *et al.* (hereinafter, "Inoue"), and further in view of Heinrich's "MIPS R4000 Microprocessor User's Manual" (hereinafter, "Heinrich"). Applicants have cancelled claims 20-39 without prejudice to, or disclaimer of, the subject matter contained therein. Thus, the rejection of these claims is moot. Applicants respectfully traverse this rejection with regard to claims 1-19 and 40-41 and have clarified the claims in support of this traversal as discussed below. Applicants note that, in the Office Action, the rejection of independent claim 11 directly refers to the rejection of independent claim 1.

The Office Action states that Koss teaches all of the elements of independent claim 1, except for performing a magnitude comparison of absolute values and using compare instructions. The Office Action then states that Koss does not disclose "performing a magnitude comparison of absolute values," but that Inoue teaches a "hardware clipping

device, which compares objects with boundaries via use of absolute values." Applicants respectfully disagree.

Koss, Inoue, and/or Heinrich, either alone or in combination, do not teach performing a comparison between absolute values, as required by independent claims 1 and 11. In Koss, at least two comparison operations need to be executed per coordinate (see Koss, col. 8, lines 42-54; col. 11, line 60 to col. 12, line 3; and comparators 206 and 208 of Figure 4). The Koss comparison operations include the comparison of signed values, not the comparison of absolute values. Similarly, in Inoue, at least two comparison operations need to be executed per coordinate (see Inoue, operations shown in registers 231-236 of Figures 1, 4, and 11; col. 5, lines 42-50). Additionally, in Inoue, each comparison operation makes a comparison with zero, not a comparison between two absolute values. Although Inoue states that it uses "absolute values w," because its operations include addition and subtraction of the "absolute values w," the operations themselves place the sign back into the comparison (see col. 5, lines 8-13). Thus, both Koss and Inoue perform two operations per coordinate, and do not perform comparisons *between* absolute values in their comparison operations.

As discussed in the present specification (page 71, lines 1-9) (emphasized note added):

By comparing the absolute values (i.e., magnitudes) instead of comparing the actual values including the sign, the present invention reduces the number of comparisons by one-half, resulting in a commensurate increase in processing speed. For example, instead of performing the following two comparisons:

$$x' \leq w' \text{ and } x' \geq -w'$$

[as both Koss and Inoue essentially do];

the present invention need only perform the single comparison:

$$|x'| \leq |w'|.$$

As also discussed in the specification (page 87, lines 18-20):

...[A] single magnitude compare (e.g., $|x| \leq |w|$) can replace the conventional two-step inequality evaluation of $x \leq w$ and $x \geq -w$ (which may be used to test view volume edges).

In other words, the present invention is able to test a single coordinate using a single comparison operation between absolute values. Koss, Inoue, and/or Heinrich do not teach or benefit from this feature, either alone or in combination. Independent claims 1 and 11 are amended accordingly to clarify this distinction.

Hence, for at least the reasons stated above, independent claims 1 and 11, and the claims that depend therefrom, are believed to be allowable. Thus, Applicants respectfully request that the rejections to claims 1-19 and 40-41 be reconsidered and withdrawn.

New Claims 42-48

Applicants have added new claims 42-48 to further distinguish the present invention. These new claims recite features similar to originally presented claims 1-41.

New claims 42-48 are dependent claims that further describe the claimed inventions of independent claims 1 and 11. New claims 42-44 depend from independent claim 1. New claims 45-48 depend from independent claim 11. Support for new claims 42-48 is found throughout the specification. For support for claims 42, 43, 46, and 47, see for example page 8, line 12 - page 9, line 2. For support for claims 44 and 48, see for example page 87, lines 10-12, page 88, line 18 - page 89, line 2, and page 90, lines 20-23. For support for claim 45, see for example page 87, lines 10-12, page 88, lines 3-5, and page 90, lines 20-23.

Because claims 42-48 depend from one of independent claims 1 and 11, they are patentable over Koss, Inoue, and/or Heinrich, alone or in combination, for at least the same reasons that independent claims 1 and 11 are patentable, and further for the specific features they recite. Entry, consideration, and allowance of new claims 42-48 are respectfully requested.

Conclusion

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicants believe that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Thekkath *et al.*
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Prompt and favorable consideration of this Amendment and Reply is respectfully requested.

Respectfully submitted,

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